

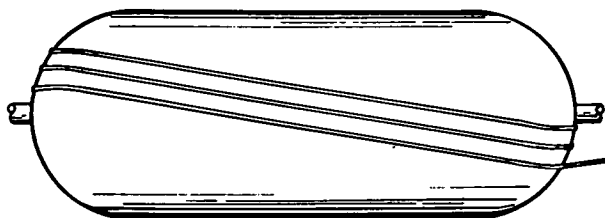
NASA TECH BRIEF

Marshall Space Flight Center

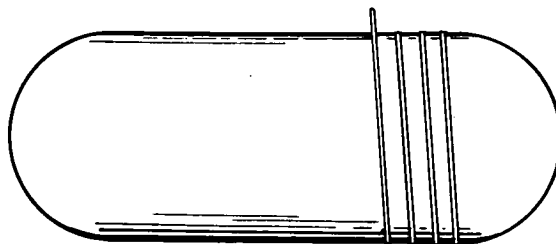


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Filament Winding Technique Produces Strong Lightweight Oxygen Tanks



Geodesic Winding Pattern



Hoop Winding Pattern

The problem:

Tanks used for transportation and storage of gases are usually constructed from thick, heavy metal cylinders that are designed to prevent possible explosion. Because of their weight, they are difficult to handle and transport. Yet, if tanks are made lighter, their safety characteristics may be jeopardized.

The solution:

Lightweight oxygen tanks have been produced by wrapping stainless steel liners with Fiberglas filament. The resulting structure exhibits the strength characteristics of much heavier metal cylinders.

How it's done:

In this process thin stainless steel tank liners (see fig.) are wrapped entirely with Fiberglas filament in a longitudinal geodesic pattern that is alternated with hoop layers. The patterns cover the entire tank surface and are wound with uniform Fiberglas thickness to provide uniform stress over the entire cylinder area.

The process is accomplished by internal pressurization of the liner to assure sufficient rigidity. The liner is then installed on the wind axis adapter which is part of the winding apparatus. The apparatus uses fully adjustable longitudinal and circular arms designed for precise winding of polar and hoop layers of Fiberglas at prescribed angles, tensions, and locations. Both arms

supply pretensioned S-glass strands (magnesium-aluminum silicate composite) collected from the spools.

Fiberglas is wound in three winding and cure sequences with the first two followed by grit blasting of the surface before the final step. The result is a uniformly stressed metal liner assembly with excellent structural characteristics.

Notes:

1. The angles of winding are very important in this technique. They have been evaluated by a computer program and are dependent on the desired design characteristics.
2. Requests for further information may be directed to:
Technology Utilization Officer
Marshall Space Flight Center
Code A&PS-TU
Marshall Space Flight Center, Alabama 35812
Reference: B73-10082

Patent status:

NASA has decided not to apply for a patent.

Source: J. F. Shuessler and R. J. Dannenmueller of
McDonnell Douglas Corp.
under contract to
Marshall Space Flight Center
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Category 08